AMENDMENTS TO THE CLAIMS

By this paper, claims 1-28, 30-37, 42-45, 50-51 and 54 have been amended and claims 38, 40, 46 – 48 have been cancelled. This listing of claims will replace all prior versions, and listings, of claims in the application:

1. **(Currently Amended)** A microneedle array device, comprising:

a substrate having a substantially planar ~~major~~ first surface and an edge adjacent said substantially planar first surface; and

a plurality of hollow non-silicon microneedles positioned on ~~the major~~ said substantially planar first surface of ~~the~~ said substrate, each of ~~the~~ said hollow non-silicon microneedles having a microchannel therethrough ~~that provides~~providing communication between at least one input port at a proximal end of each of ~~the~~ said hollow non-silicon microneedles and at least one output port at ~~an opposite~~ a distal end of each of said hollow non-silicon microneedles, wherein said hollow non-silicon microneedles ~~that extends~~ extend beyond ~~saidan~~ edge of ~~the~~ said substrate and ~~; wherein the microneedles are located on the major surface of the substrate such that the microneedles~~ extend in a direction substantially parallel to ~~the major~~ said substantially planar first surface.

2. **(Currently Amended)** The microneedle array device of claim 1, wherein ~~the~~ said hollow non-silicon microneedles each have a bottom wall, two side walls, and a top wall ~~that define~~defining a microchannel.

3. **(Currently Amended)** The microneedle array device of claim 2, wherein ~~the~~ said bottom wall is formed at least partially on top of ~~the major~~ said substantially planar first

surface of ~~the~~ said substrate and ~~the~~ said side walls and top wall are formed around a removable molding material.

4. **(Currently Amended)** The microneedle array device of claim 1, wherein ~~the~~ said hollow non-silicon microneedles comprise a two dimensional array.

5. **(Currently Amended)** The microneedle array device of claim 1, wherein said hollow non-silicon ~~the~~ microneedles comprise a three dimensional array.

6. **(Currently Amended)** The microneedle array device of claim 5, wherein ~~the~~ said three dimensional array comprises a plurality of two dimensional arrays with spacers therebetween.

7. **(Currently Amended)** The microneedle array device of claim 6, wherein ~~the~~ said three dimensional array is bonded together by a material selected from the group consisting of molding materials, polymeric adhesives, and combinations thereof.

8. **(Currently Amended)** The microneedle array device of claim 1, wherein said hollow non-silicon ~~the~~ microneedles are aligned substantially parallel to each other on ~~the~~ said substrate.

9. **(Currently Amended)** The microneedle array device of claim 1, wherein the distal end of each said hollow non-silicon microneedle extends beyond ~~the~~ said edge of ~~the~~ said

substrate a distance from about 10 μm to about 100 mm.

10. **(Currently Amended)** The microneedle array device of claim 1, wherein ~~the~~ said microchannel in each of said hollow non-silicon ~~the~~ microneedles has a cross-sectional area in the range from about 25 μm^2 to about 5000 μm^2.

11. **(Currently Amended)** The microneedle array device of claim 1, wherein the length of each said hollow non-silicon microneedle is from about 0.05 μm to about 5 mm, and the width of each said hollow non-silicon microneedle is from about 0.05 μm to about 1 mm.

12. **(Currently Amended)** The microneedle array device of claim 1, wherein the center-to-center spacing between individual said hollow non-silicon microneedles is from about 50 μm to about 200 μm.

13. **(Currently Amended)** The microneedle array device of claim 1, wherein ~~the~~ said substrate comprises a material selected from the group consisting of glass, semiconductor materials, metals, ceramics, plastics, and composites or combinations thereof.

14. **(Currently Amended)** The microneedle array device of claim 1, wherein said hollow non-silicon ~~the~~ microneedles comprise a material selected from the group consisting of metals, plastics, ceramics, glass, carbon black, and composites or combinations thereof.

15. **(Currently Amended)** The microneedle array device of claim 1, wherein said

hollow non-silicon ~~the~~ microneedles comprise a metal material selected from the group consisting of nickel, copper, gold, palladium, titanium, chromium, and alloys or combinations thereof.

16. **(Currently Amended)** The microneedle array device of claim 1, wherein said hollow non-silicon ~~the~~ microneedles can withstand flow rates of up to about 1.5 cc/sec.

17. **(Currently Amended)** The microneedle array device of claim 1, further comprising a coupling channel member ~~that provides~~ providing fluid communication between said hollow non-silicon ~~the~~ microneedles.

18. **(Currently Amended)** The microneedle array device of claim 17, wherein ~~the~~ said coupling channel member is composed of the same material as said hollow non-silicon ~~the~~ microneedles.

19. **(Currently Amended)** The microneedle array device of claim 1, further comprising a pair of structural support members ~~that~~ mechanically interconnecting said hollow non-silicon~~the~~ microneedles and ~~that~~ precisely controlling penetration depth of said hollow non-silicon ~~the~~ microneedles.

20. **(Currently Amended)** The microneedle array device of claim 1, wherein said hollow non-silicon ~~the~~ microneedles have a plurality of input ports.

21. **(Currently Amended)** The microneedle array device of claim 1, wherein said hollow non-silicon ~~the~~ microneedles have a plurality of output ports.

22. **(Currently Amended)** A microneedle array device, comprising:

a plurality of hollow non-silicon microneedles having a microchannel therethrough ~~that provides~~ providing communication between at least one input port at a proximal end of each of ~~the~~ said hollow non-silicon microneedles and at least one output port and a channel opening at ~~an opposite~~a distal end of each of said hollow non-silicon microneedles;

at least one first structural support member ~~that interconnects~~ interconnecting said hollow non-silicon~~the~~ microneedles adjacent the proximal end of said hollow non-silicon ~~the~~ microneedles; and

at least one second structural support member ~~that interconnects~~interconnecting said hollow non-silicon~~the~~ microneedles adjacent the distal end of said hollow non-silicon ~~the~~ microneedles.

23. **(Currently Amended)** The microneedle array device of claim 22, wherein said hollow non-silicon ~~the~~ microneedles each have a bottom wall, two side walls, and a top wall ~~that~~ ~~define~~defining a microchannel.

24. **(Currently Amended)** The microneedle array device of claim 22, wherein said hollow non-silicon ~~the~~ microneedles comprise a two dimensional array.

25. **(Currently Amended)** The microneedle array device of claim 22, wherein said hollow non-silicon ~~the~~ microneedles comprise a three dimensional array.

26. **(Currently Amended)** The microneedle array device of claim 22, wherein said hollow non-silicon ~~the~~ microneedles comprise a material selected from the group consisting of metals, plastics, ceramics, glass, carbon black, and composites or combinations thereof.

27. **(Currently Amended)** The microneedle array device of claim 22, wherein said hollow non-silicon ~~the~~ microneedles comprise a metal material selected from the group consisting of nickel, copper, gold, palladium, titanium, chromium, and alloys or combinations thereof.

28. **(Currently Amended)** The microneedle array device of claim 22, further comprising a coupling channel member ~~that provides~~providing fluid communication between said hollow non-silicon ~~the~~ microneedles.

29. **(Cancelled)**

30. **(Currently Amended)** The microneedle array device of claim 22, wherein ~~the~~ said structural support members precisely control penetration depth of said hollow non-silicon ~~the~~ microneedles.

31. **(Currently Amended)** The microneedle array device of claim 22, wherein said hollow non-silicon ~~the~~ microneedles have a plurality of input ports.

32. **(Currently Amended)** The microneedle array device of claim 22, wherein said hollow non-silicon ~~the~~ microneedles have a plurality of output ports.

33. **(Currently Amended)** A microneedle device, comprising:

a substrate having a substantially planar first surface and an edge adjacent said substantially planar first surface; and

a single hollow non-silicon microneedle positioned on ~~the planar~~ said substantially planar first surface of ~~the~~ said substrate, said hollow non-silicon ~~the~~ microneedle having at least one microchannel therethrough ~~that provides~~providing communication between at least one input port at a proximal end of said hollow non-silicon ~~the~~ microneedle and at least one output port at ~~an opposite~~a distal end of said hollow non-silicon microneedle, the distal end of said hollow non-silicon microneedle extending~~that extends~~ beyond ~~an~~ said edge of ~~the~~ said substrate, wherein said hollow non-silicon microneedle extends in a direction substantially parallel to said substantially parallel first surface.

34. **(Currently Amended)** The microneedle device of claim 33, wherein the distal end of said hollow non-silicon ~~the~~ microneedle extends beyond ~~the~~ said edge of ~~the~~ said substrate a distance from about 10 μm to about 100 mm.

35. **(Currently Amended)** The microneedle device of claim 33, wherein ~~the~~ said microchannel in said hollow non-silicon ~~the~~ microneedle has a cross-sectional area in the range from about 25 μm^2 to about 5000 μm^2.

36. **(Currently Amended)** The microneedle device of claim 33, wherein ~~the~~ said substrate comprises a material selected from the group consisting of glass, semiconductor

materials, metals, ceramics, plastics, and composites or combinations thereof.

37. **(Currently Amended)** The microneedle device of claim 33, wherein said hollow non-silicon ~~the~~ microneedle comprises a metal material selected from the group consisting of nickel, copper, gold, palladium, titanium, chromium, and alloys or combinations thereof.

38. **(Cancelled)**

39. **(Original)** The microneedle device of claim 33, wherein the distal end has a plurality of output ports.

40. **(Cancelled)**

41. **(Original)** The microneedle device of claim 33, further comprising a structural support to control penetration depth.

42. **(Currently Amended)** The microneedle device of claim 41, wherein ~~the~~ said structural support is adapted to mechanically fix the microneedle device to a surface that is penetrated by said hollow non-silicon ~~the~~ microneedle.

43. **(Currently Amended)** A microneedle device, comprising:

a single hollow elongated shaft comprised of a non-silicon material, ~~the~~ said hollow elongated shaft defining at least one microchannel therethrough and having a proximal end and a distal end; and

at least one input port at the proximal end of ~~the~~ said hollow elongated shaft and ~~at least one~~ a plurality of output ports at the distal end, ~~the~~ said microchannel providing communication between ~~the~~ said at least one input port and ~~the~~ at least one of said output ports.

44. **(Currently Amended)** The microneedle device of claim 43, wherein ~~the~~ said microchannel has a cross-sectional area in the range from about 25 μm^2 to about 5000 μm^2.

45. **(Currently Amended)** The microneedle device of claim 43, wherein ~~the~~ said hollow elongated shaft comprises a metal material selected from the group consisting of nickel, copper, gold, palladium, titanium, chromium, and alloys or combinations thereof.

46. **(Cancelled)**

47. **(Cancelled)**

48. **(Cancelled)**

49. **(Original)** The microneedle device of claim 43, further comprising a structural support to control penetration depth.

50. **(Currently Amended)** The microneedle device of claim 49, wherein ~~the~~ said structural support is adapted to mechanically fix the microneedle device to a surface that is penetrated by ~~the~~ said hollow elongated shaft.

51. **(Currently Amended)** A method of fabricating a microneedle, comprising:

providing a substrate with a substantially planar ~~major~~ first surface;

depositing a metal material on ~~the major~~ said substantially planar first surface to form one or more bottom walls for one or more microneedles;

coating a top surface of ~~the~~ said one or more bottom walls with a photoresist layer to a height corresponding to a selected inner height of a microchannel for ~~the~~ said one or more microneedles;

depositing a metal material to form side walls and a top wall upon ~~the~~ said one or more bottom walls and around ~~the~~ said photoresist layer; and

removing ~~the~~ said photoresist layer from ~~the~~ said microchannel of ~~the~~ said one or more microneedles; wherein ~~the~~ said one or more microneedles are formed on ~~the major~~ said substantially planar first surface of ~~the~~ said substrate ~~such that the microneedles~~ and extend in a direction substantially parallel to ~~the major~~ said substantially planar first surface.

52. **(Original)** The method of claim 51, wherein the metal material is deposited by an electroplating process.

53. **(Original)** The method of claim 51, wherein the metal material is selected from the group consisting of palladium, titanium, chromium, nickel, gold, copper, and alloys thereof.

54. **(Currently Amended)** The microneedle array device of claim 22, wherein ~~the~~ said one or more microneedles are mechanically interconnected by a plurality of structural support members.